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Subject: EVALUATION OF ROD TO ROD BLEND VARIATION

OBJECTIVE:

To identify how much rod to rod variation exists in the cigarette blend components of Industry Monitor #14 and what amount of that total variation is due to the analytical measurement.

INTRODUCTION:

The measurement of blend components is performed in the Microscopy section utilizing acetone floatation and microscopic picking of materials. Because these processes are manual and tedious, it is necessary to also identify the variation in the method and the repeatability within the same person performing the test when attempting to measure the variation in the product.

TEST PLAN:

A. RL, RCB, and ES were picked under a microscope by two (2) different subjects, using the same 10 cigarettes of Industry Monitor #14. The samples (center third of rod) were evaluated by one subject, placed in glass jars, then evaluated by the other subject. In addition, each cigarette was re-picked by one person. Each cigarette was picked a total of three (3) times.

B. Since the method for measuring ET is a destructive test (floating in acetone), the same samples could not be used by two different subjects. Each subject evaluated 10 cigarettes of Industry Monitor #14.

RESULTS:

A. ES

Of the 20 ES measurements recorded (twice for each sample), the percentages ranged from 1.6 to 3.6, with an overall average of 2.5. The total variance was 0.37 which is a 24.2% relative standard deviation (standard deviation as a percent of the mean). Of this total variance, the variance due to the analytical measurement was 0.15 which equates to a relative standard deviation of 15.6%, while the variance due to the cigarette production process was 0.22, or a relative standard deviation of 18.5%. Of the 20 ES measurements recorded where the same person re-picked the same sample, the percentages again ranged from 1.6 to 3.6, with an overall mean of 2.7. The variance from the same person re-picking the sample was 0.11, or a relative standard deviation of 12.3% of the measurement.

Source: https://www.industrydocuments.ucsf.edu/docs/xkmk0001

B. RL

Of the 20 RL measurements recorded (twice for each sample), the percentages ranged from 10.3 to 20.8, with an overall average of 15.5. The total variance was 10.17 which is a 20.6% relative standard deviation. Of this total variance, the variance due to the analytical measurement was 0.05 which equates to a relative standard deviation of only 1.4%, while the variance due to the cigarette production process was 10.12,or a relative standard deviation of 20.5%. Of the 20 RL measurements recorded where the same person re-picked the same sample, the percentages ranged from 9.8 to 20.9, with an overall mean of 15.7. The variance from the same person re-picking the sample was 0.35, or a relative standard deviation of only 3.7% of the measurement.

C. RCB

Of the 20 RCB measurements recorded (twice for each sample), the percentages ranged from 4.0 to 9.6, with an overall average of 6.8. The total variance was 3.06 which is a 25.9% relative standard deviation. Of this total variance, the variance due to the analytical measurement was only 0.13 which equates to a relative standard deviation of only 5.4%, while the variance due to the cigarette production process was 2.93, or a relative standard deviation of 25.3%. Of the 20 RCB measurements recorded where the same person re-picked the same sample, the percentages ranged from 4.0 to 10.7, with an overall mean of 6.9. The variance from the same person re-picking the sample was only 0.22, or a relative standard deviation of only 6.8% of the measurement.

D. ET

Of the 20 ET measurements recorded (20 different samples), the percentages ranged from 9.5 to 13.9, with an overall average of 10.6. The total variance was 1.37, which is only an 11.0% relative standard deviation. Since the samples could not be re-floated, we cannot determine how much of this variance is due to analytical measurement error.

E. TOBACCO

Of the tobacco measurements recorded (twice for each sample), the percentage ranged from 70.8 to 82.2, with an overall average of 74.8. The total variance was 10.9 which is a 4.0% relative standard deviation. Of this total variance, the variance due to the analytical measurement was 0.21 which equates to a relative standard deviation of only 0.6%, while the variance due to the cigarette production process was 10.7, or a relative standard deviation of only 4.0%. Of the 20 tobacco measurements recorded where the same person re-picked the same sample, the percentages ranged from 71.6 to 82.2, with an overall mean of 75.3. The variance from the same person re-picking the sample was 10.6, or a relative standard deviation of only 4.3% of the measurement.

CONCLUSIONS:

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Relative to their average measurements of 15.5 and 6.8, the standard deviations for RL and RCB were 20.6% and 25.9%, respectively. For both of these components, the variation was predominantly found to be a result of the cigarette production process, as opposed to a result of the analytical measurement process.

The ES measurements showed a higher variance due to measurement, however the majority of the total variance can be attributed to the variation in the cigarette production process.

The total variance in the ET measurements was much lower than the other components, at 11.0% of an average 10.6% ET.

Relative to the average measurements, the standard deviation for tobacco was only 4.4%. The variation was predominantly found to be a result of the cigarette production process, as opposed to the analytical measurement.

The data obtained from this study indicate a need to investigate the variation in the blends of production brands other than Industry Monitor #14. Further testing and analysis is currently underway.

	PERCENT			VARIANCE		
COMPONENT	AVE.	MIN	MAX	TOTAL	MEAS.	PROD.
ES	2.5	1.6	3.6	0.37	0.15	0.22
RL	15.5	10.3	20.8	10.17	0.05	10.12
RCB	6.8	4.0	9.6	3.06	0.13	2.93
ET	10.6	9.5	13.9	1.37		
TOB	74.8	70.8	82.2	10.90	0.21	10.69

	PERCENT			RELATIVE STANDARD DEV.		
COMPONENT	AVE.	MIN	MAX	TOTAL	MEAS.	PROD.
ES	2.5	1.6	3.6	24.2%	15.6%	18.5%
RL	15.5	10.3	20.8	20.6%	1.4%	20.5%
RCB	6.8	4.0	9.6	25.9%	5.4%	25.3%
ET	10.6	9.5	13.9	11.0%		
TOB	74.8	70.8	82.2	4.0%	0.6%	4.0%

cc: Bob Fenner
Nancy Ryan

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